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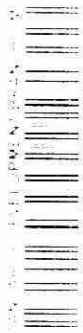
TECHNICAL MEMORANDUM

MOBILE AIR MONITORING SURVEY

REICHOLD LIMITED

NORTH BAY, ONTARIO

November 1986

ARB-001-87-AQM

May 1987

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1987

Ontario Ministry of the Environment

E. PICHÉ, Director
Air Resources Branch

70324

TECHNICAL MEMORANDUM

MOBILE AIR MONITORING SURVEY: REICHHOLD LIMITED NORTH BAY, ONTARIO

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ARB-001-87-AQM

Prepared for:

The Northeastern Region
Ontario Ministry of the Environment

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Air Resources Branch
Ontario Ministry of the Environment

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EXECUTIVE SUMMARY

As requested by the Northeastern Region the Monitoring and Instrumentation Development Unit of the Air Resources Branch dispatched two of the Mobile Air Monitoring Units (MAMUs), including the TAGA, to North Bay, Ontario during the week of November 17, 1986. The survey objective was to identify and quantitate the odourous emissions from Reichhold Limited.

On November 20, sampling and analysis of the Reichhold plume were performed in the field by the MAMU #1 and TAGA during the occurrence of phenolic odours. Gas chromatographic analysis of several 30-minute air samples (4) indicated that the total hydrocarbon loadings (133 target compounds) were actually lower than the urban background levels (caused by vehicle exhaust and other combustion sources). The mobile TAGA unit screened the air for all polar compounds detectable by APCI/MS: phenol was the only compound detected in the Reichhold plume. The 30-minute averaged concentrations were 23, 7.3, 36, and 28 ug/m^3, well below the Ministry Standard of 100 ug/m^3. However, the instantaneous levels of phenol approached 150 ug/m^3 which were sufficient to result in phenolic odours at the sampling sites 350 metres downwind of Reichhold Limited.

1.0 Introduction

At the request of the Northeastern Region, the Monitoring and Instrumentation Development Unit of the Air Resources Branch conducted an exploratory mobile air monitoring survey in North Bay during the week of November 17, 1986. The primary objectives of this survey were to identify and quantitate the odourous pollutants originating from Reichhold Limited, a phenol-formaldehyde resin plant located on Wallace Road. In order to provide a more thorough analysis of the odours two of the Mobile Air Monitoring Units (MAMUs) were utilized: the MAMU #1 and the MAMU #3 (TAGA).

To assist the Ministry of the Environment with this study, the Reichhold management agreed to process those products believed to be the likely cause of the malodours. The processes of concern were apparently in operation for approximately 60 hours, commencing November 18, 1986 at 18:00 hours. Despite the non-ideal weather conditions, odour incidents were evident during some of the monitoring periods. The findings of both the MAMU #1 and the TAGA are presented herein.

2.0 The MAMUs

The analytical capabilities of the MAMU #1 and the TAGA are quite different, yet they are complementary. For instance, the TAGA, which is basically a specialized mass spectrometer, is most sensitive to polar organics such as acids, aldehydes and phenols. By contrast, MAMU #1 is equipped to monitor non-polar compounds, for example aliphatic and aromatic hydrocarbons.

2.1 MAMU #1

The MAMU #1 contains several discreet analysers for the continuous measurement of ambient levels of total reduced sulfur (TRS), carbon monoxide (CO), nitrogen oxides (NO_X), ozone (O_3), total hydrocarbons (THC), and sulfur dioxide (SO_2). A comprehensive listing of MAMU #1's instrumentation is provided in Table 1. Perhaps the key instrument of the MAMU #1 for this particular survey was the gas chromatograph (GC). The MAMU #1 has been outfitted with a dual capillary column gas chromatograph with flame ionization detectors (Hewlett-Packard 5880). Prior to injection into the GC, air pollutants are preconcentrated on a multi-stage adsorbent cartridge, followed by thermal desorption and cryogenic focusing at the head of the GC columns. This combination of preconcentrator and dual column GC allows for the detection and quantitation of over 130 common hydrocarbons, including: alkanes, alkenes, alkynes, aromatic and some chlorinated compounds. Typical detection limits are in the 1 to 10 ug/m^3 range. The compounds monitored by MAMU #1 are listed in Table 2. Note that the MAMU #1 only screens the air for non-polar constituents.

2.2 TAGA and Phenol Detection

The Trace Atmospheric Gas Analyzer (TAGA), model 3000, is a specialized quadrupole mass spectrometer with an unique air sampling inlet system (see Figure 1). Ambient air is sampled at a high flow rate (100 l/min) directly into an atmospheric-pressure chemical ionization (APCI) ion source. Contaminants are selectively ionized (according to chemical class) through a low energy chemical ionization process initiated by a stable corona discharge. Ionized pollutants are then instantly mass analysed using a quadrupole mass

spectrometer. The sampling and analysis process occurs in approximately one second.

Direct air sampling, together with APCI/MS, affords real-time detection of a broad range of organic and inorganic pollutants at ultra trace levels. The contaminants detectable by the TAGA constitute a variety of chemical classes, namely: alcohols, amines, aldehydes, ketones, esters, acids, phenols, sulfides and chlorinated aromatics. In general, the TAGA system is sensitive to any gaseous compound containing a heteroatom, such as N, O, or halides. The real-time detection limits of the TAGA range from 0.1 to 10 ug/m^3 depending on the type of chemical class and the sample matrix. It should be noted that the TAGA, when equipped with the APCI ion source, is not sensitive to formaldehyde.

Real-time detection of ambient phenol is accomplished by the TAGA through two chemical ionization (CI) methods:

1. The formation of molecular phenol ions ($C_6H_6O^+$) is observed through benzene chemical ionization in the positive ion mode; and,

2. In the negative mode, oxygen CI readily yields phenoxide ions ($C_6H_5O^-$) from traces of gaseous phenol.

Calibration of the TAGA, including the sampling inlet system, is achieved by injecting known amounts of phenol via a motorized syringe injector, into the sampling air stream. For this particular survey, phenol calibrations were conducted at least once daily for each operating mode (positive and negative). An example of a phenol calibration curve recorded in North Bay is shown in Figure 2. The detection limits achieved for phenol were in the order of 1 ug/m^3. The detection limits for the TAGA are

defined as 3 times the standard deviation of the background signal divided by the slope of the calibration curve.

The simultaneous acquisition of meteorological parameters and air quality data is essential for source delineation. Thus both the MAMU #1 and TAGA possess a complete meteorological instrumentation package. Local wind speed and wind direction data are provided by a wind vane and anemometer mounted on a 10 metre telescopic tower. Ambient temperature, barometric pressure, solar radiation, and dew point are also recorded.

3.0 Results and Discussion

Since the TAGA is a real-time monitoring device it is ideal for addressing odour problems. Monitoring techniques that require long sampling times and yield integrated samples are usually inappropriate for chemically characterizing odours, for the malodourous episodes may be brief and without a predictable pattern. The survey strategy was to position the MAMUs directly downwind of Reichhold and analyse numerous air samples, especially during the occurrence of odours. In addition to downwind measurements, the MAMUs also recorded background levels of targeted pollutants at locations upwind of Reichhold.

Air monitoring by MAMU #1 and the TAGA was conducted on November 18, 19 and 20, 1986. All measurements were acquired off plant property within approximately 500 metres of Reichhold. The management at Reichhold had assured the Ministry that the plant would be in operation during the survey. The plant came on-line at roughly 18:00 hours on November 18, and apparently continued operation for 60 hours.

3.1 Tuesday .... November 18

The data pertaining to November 18 can be considered background, as Reichhold was not in full operation until after the monitoring day had ended. During the morning the MAMUs were situated on Mountainview Drive, upwind of Reichhold. The winds were light (0 - 10 km/hr) and northeasterly. Ambient temperatures hovered around -8°C.

All contaminants measured by MAMU #1 (Tables 3 and 4) were extremely low and indicative of fossil fuel combustion sources; that is, vehicular exhaust and home furnaces. Background levels of phenols were not detected by the TAGA (see Table 5, sample #1-1).

After 14:00 hours MAMU #1 relocated to the parking lot of the Lee/Canadore building (site B), which is roughly 400 metres downwind of Reichhold. One 30-minute air sample was collected using absorbent cartridges and GC analysed. Organic loadings were similar to those obtained at the previous upwind location. Pollutant levels were orders of magnitude below any applicable MOE standards.

3.2 Wednesday .... November 19

After acquiring background readings and performing calibrations, the MAMU #1 and TAGA set up east of Reichhold. The TAGA was situated on Mountainview Drive near Michener Drive (site #3), whereas the MAMU #1 was parked opposite #124 K&K Drive (site A). Winds were very light and from the southwest. Although Reichhold was operational no odours were perceived by the MAMU staff. This was not surprising since the Reichhold plumes were going virtually straight up and not impinging near the monitoring locations.

From the GC analysis of the air samples it was evident that hydrocarbon loadings were much lower than those recorded on the previous day (86 versus 230 ug/m^3). Once again we attributed the local hydrocarbon loadings to combustion sources. However, an interesting aspect of the GC results on this particular day was the appearance of an unknown peak eluted from the GC column at 2.25 minutes. It was not identified as one of the 133 target compounds in our retention index library. Although this mystery peak only accounted for 6% of the total peak area, it is mentioned here because it appears in future chromatograms.

For a brief period during the afternoon of November 19 the TAGA detected phenol at site #3 (see Table 5, sample #3-2). The ½-hour averaged concentration was 3.2 ug/m^3, while the single highest (instantaneous) reading recorded during the ½-hour period was 31 ug/m^3. Note that phenolic odours were not obvious at this time. However, the winds were southwest, albeit for brief periods, indicating Reichhold to be the source of the phenol.

3.3 Thursday .... November 20

Just after 09:00 hours the MAMU #1 commenced monitoring at Alexander and Veronica (Site C) with the acquisition of common pollutants data and the first of four 30-minute GC samples. The winds were averaging 20 km/hr from the east. Thus the sampling location was indeed downwind. A slight to moderate phenolic odour was present at irregular, yet frequent, intervals.

The common contaminants data (Table 3) indicated that the maximum 30-minute averaged concentrations were well below the applicable Ministry Standards. Based on the analyses

of the four GC samples the total hydrocarbon loadings were also very light: the maximum 30-minute averaged concentration was only 40 ug/m^3 (Table 4).

An interesting feature of these four chromatograms was the reoccurrence of the unknown peak at the retention time of 2.25 minutes. The peak area of this compound accounted for 35% to 74% of the total peak area. This peak area would equate to roughly 10 to 30 ug/m^3, assuming it is a hydrocarbon. In January 1987 we experimented with formaldehyde and the MAMU's preconcentrator-GC system. It was discovered that the mystery peak was not formaldehyde. As well, the retention time is much too early for the peak to be phenol. Since the MAMU #1 can only observe non-polar compounds the mystery peak must be an aliphatic hydrocarbon.

The acquired GC data sets for this survey were divided into two comparison groups: the data acquired on November 18 and 19, versus the data from November 20, 1986. As clearly shown in Figure 5 the hydrocarbon loadings were much lower on Thursday November 20, the only day Reichhold odours were evident.

The lower hydrocarbon levels recorded by MAMU #1 can be attributed to the probable source: vehicular traffic and other combustion sources, as opposed to Reichhold. Note that Site C was situated in a new subdivision with very little vehicle activity in the area. This is in contrast to Site A where Mountainview Drive had comparably greater traffic volumes, and the highest hydrocarbon levels.

In stark contrast to the MAMU #1's findings the TAGA results of November 20 were more eventful. The monitoring periods were divided between two sites, 4 and 5. Both of

these sampling sites were located on Veronica Road just south of the MAMU #1 (see Figure 4). In all, 4 ½-hour averaged concentrations of phenol were determined using the TAGA in the selected ion (pollutant) mode. The phenol concentrations ranged from 7.3 ug/m³ to 36 ug/m³ for a ½-hour average (see Table 5). The Ministry Standard for phenol is 100 ug/m³ for a ½-hour averaged concentration.

An example of the real-time levels of phenol as obtained by the TAGA is given in Figure 6. Our monitoring location was approximately 350 metres downwind of Reichhold on Veronica Road (Site #4). Instantaneous levels of phenol were recorded every 5 seconds for a period of 1 hour beginning at 10:03 hours. The excursions in the phenol concentrations coincided with the detection of phenolic odours. Note that many of the phenol readings exceeded the odour threshold value of 22 ug/m³ for phenol (van Gemert et.al., 1977). Although the ½-hour averaged concentrations were low, the time resolved trace shows phenol levels in excess of 100 ug/m³, albeit for brief periods. The phenol levels recorded at Site #5 were slightly higher than those at Site #4. But the odours appeared to be more prevalent at Site #5.

In addition to phenol monitoring, the air was screened for all compounds detectable by the TAGA 3000. This was accomplished through the comparison of the mass spectra (up to 250 amu) collected during odour episodes with that of the background spectra. With the exception of phenol, no other compounds were detected, including aldehydes, acids and substituted phenols.

TABLE #1

THE INSTRUMENTATION OF MOBILE AIR MONITORING UNIT #1

Instrument	Manufacturer	Analytical Technique	Full Scale Sensitivity
THC, CH4, TH-M analyzer	Ingenieur-Produktions-Gruppe Munchen (IPM) RS-t	Dual flame ionization	50 ppm THC (as CH4)
H2S,SO2,NOx sources	Hartmann & Braun Prufgasgenerator	N/A	N/A
TRS/SO2 analyzer	Monitor Labs 8850 c/w ML 8770	Fluorescence	1.0 ppm SO2 0.5 ppm TRS
NOx, NO2, NO analyzer	Monitor Labs 8840	Chemi-Luminescence	1.0 ppm NOx (as NO2)
CO analyzer	Thermo Electron P48	Gas Filter Correlation	100 ppm CO
O3 analyzer/ source	Dasibi 1003-AAS	UV Absorption	1.0 ppm O3
CO & THC sources	Matheson	Compressed Gas	N/A
Gas Chromatograph	HP 5880 Dual Capillary Column	Flame Ion-ization Det.	as set per calibrations

Meteorological Instrumentation

Instrument	Manufacturer	Scale
** Wind speed	Lambrecht GmBH	km/hr
** Wind direction	Lambrecht GmBH	degrees
Temperature	Weather Measure (WM) T621	degrees Celsius
Humidity	WM-HM-11P	absolute & %
Barometric pressure	WM-BM70-B242	millibars
Solar Radiation	WM Star Pyranometer	milliwatts/cm2

** These instruments are located on top of a 10 metre retractable tower

CHEMICAL COMPOUND LIST FOR MOBILE AIR MONITORING UNITS #1 AND #2

TABLE #2

ALKANES

ETHANE
PROPANE
2-METHYLPROPANE
BUTANE
2-METHYLBUTANE
PENTANE
2,2-DIMETHYLBUTANE
2,3-DIMETHYLBUTANE
2-METHYLPENTANE
3-METHYLPENTANE
HEXANE
2-METHYLHEXANE
2,3-DIMETHYLPENTANE
3-METHYLHEXANE
2,2,4-TRIMETHYLPENTANE
HEPTANE
2,5-DIMETHYLHEXANE
2-METHYLHEPTANE
4-METHYLHEPTANE
3-METHYLHEPTANE
OCTANE
4-METHYLOCTANE
2-METHYLOCTANE
3-METHYLOCTANE
NONANE
DECANE
UNDECANE
DODECANE

CYCLOALKANES

CYCLOPROPANE
CYCLOPENTANE
METHYLCYCLOPENTANE
CYCLOHEXANE
METHYLCYCLOHEXANE
TRANS12DIMETHYLCYCLOHEXANE
PROPYLCYCLOPENTANE
cis-1,2-DIMETHYLCYCLOHEXANE
ETHYLCYCLOHEXANE
tert-BUTYLCYCLOHEXANE
BUTYLCYCLOHEXANE

ALKENES

PROPADIENE
1-BUTENE
1,3-BUTADIENE
3-METHYL-1-BUTENE
1-PENTENE
2-METHYL-1,3-BUTADIENE
TRANS-2-PENTENE
cis-2-PENTENE
2-METHYL-2-BUTENE
4-METHYL-1-PENTENE
3-METHYL-1-PENTENE
1-HEXENE
TRANS-3-HEXENE
1-HEPTENE
TRANS-2-HEPTENE
1-OCTENE
TRANS-4-OCTENE
2-METHYL-1-HEPTENE
2-OCTENE
1-NONENE
1-DECENE

CYCLOALKENES

CYCLOHEXENE
4-METHYLCYCLOHEXENE

ALKYNES

PROPYNE
1-BUTYNE

AROMATICS

BENZENE
TOLUENE
ETHYLBENZENE
M-XYLENE
P-XYLENE
STYRENE
O-XYLENE
ISOPROPYLBENZENE
PROPYLBENZENE
4-ETHYLTOLUENE
3-ETHYLTOLUENE
1,3,5-TRIMETHYLBENZENE
2-ETHYLTOLUENE
tert-BUTYLBENZENE
1,2,4-TRIMETHYLBENZENE
ISOBUTYLBENZENE
sec-BUTYLBENZENE
1,2,3-TRIMETHYLBENZENE
ISOPROPYL-4-METHYLBENZENE
INDAN
1,3-DIETHYLBENZENE
1,4-DIETHYLBENZENE
BUTYLBENZENE
1,2-DIETHYLBENZENE
T-DECALIN
C-DECALIN
1235-TETRAMETHYLBENZENE
1234-TETRAMETHYLBENZENE
1234-TETRAHYDRONAPHALENE
1,4-DIISOPROPYLBENZENE

CHLORINATED AROMATICS

CHLOROBENZENE
2-CHLOROTOLUENE
3-CHLOROTOLUENE
4-CHLOROTOLUENE
1,3-DICHLOROBENZENE
(CHLOROMETHYL) BENZENE
1,2-DICHLOROBENZENE

CHLORINATED ALKANES

CHLOROMETHANE
CHLOROETHANE
DICHLOROMETHANE
2-CHLORO-2-METHYLPROPANE
2-CHLOROBUTANE
TRICHLOROMETHANE
1,2-DICHLOROETHANE
1,1,1-TRICHLOROETHANE
1-CHLOROBUTANE
TETRACHLOROMETHANE
DIBROMOMETHANE
1,2-DICHLOROPROPANE
1-CHLORO-3-METHYLBUTANE
1-CHLOROPENTANE
1,1,2-TRICHLOROETHANE
1,3-DICHLOROPROPANE
1,2-DIBROMOMETHANE
1-CHLOROHEXANE
1,4-DICHLOROBUTANE
1,1,2,2-TETRACHLOROETHANE
1,2,3-TRICHLOROPROPANE
1,5-DICHLOROPENTANE
3-(CHLOROMETHYL)HEPTANE

CHLORINATED ALKENES

CHLOROETHENE
3-CHLOROPROPENE
trans-1,2-DICHLOROETHENE
cis-1,2-DICHLOROETHENE
3-CHLORO-2-METHYLPROPENE
2,3-DICHLOROPROPENE
TRICHLOROETHENE
TETRACHLOROETHENE
trans-1,4-DICHLORO-2-BUTENE

COMMON CONTAMINANTS

TOTAL REDUCED SULPHUR COMPOUNDS
SULPHUR DIOXIDE
CARBON MONOXIDE
OXIDES OF NITROGEN (NOx, NO2 AND NO)

UPPER AIR MINISONDE SOUNDINGS

COMMON CONTAMINANTS ctd.

TOTAL HYDROCARBONS (THC, TH-M AND CH4)
MERCURY
OZONE
METEOROLOGICAL : WIND SPEED & DIRECTION
TEMPERATURE
DEW POINT TEMPERATURE
BAROMETRIC PRESSURE
SOLAR RADIATION

TABLE #3

MONITORING PERIODS/SITES
and
COMMON CONTAMINANTS

Monitoring Date	Map ID	Start Time	Duration	#GC Runs	Comments
11/18	A	11:03	3.0 hrs	1	Upwind
11/18	B	14:26	1.1 hrs	1	Downwind
11/19	C	09:52	1.3 hrs	0	Calm
11/19	A	14:00	2.7 hrs	1	Calm
11/20	C	09:03	5.1 hrs	4	Downwind

COMMON CONTAMINANTS

Overall Average Ground Level Concentrations (ppm)

Monitoring Date	CO	TRS	NOX	THC	O3	TH-M	Wind
11/18	1.13	0.001	0.04	2.98	0.02	1.83	0802
11/18	0.22	0.001	0.02	2.25	0.02	0.97	3601
11/19	1.79	0.001	0.07	2.36	0.02	1.03	1402
11/19	5.40	0.001	0.10	2.77	0.03	1.40	1801
11/20	0.39	0.001	0.02	2.87	0.03	1.34	0918

Maximum Half-Hour Average Concentrations

11/18	2.56	0.001	0.05	3.61	0.02	2.37
11/18	0.25	0.001	0.03	2.51	0.02	1.27
11/19	2.60	0.001	0.09	2.66	0.03	1.30
11/19	9.65	0.001	0.14	3.38	0.03	1.93
11/20	0.93	0.001	0.03	3.20	0.03	1.73

Carbon Monoxide (CO) Total Reduced Sulphur Compounds (TRS)
Oxides of Nitrogen (NOX) Total Hydrocarbons (THC)
Ozone (O3) Non-Methane Hydrocarbons (TH-M)
Wind aabb where aa is average direction (nearest 10 degrees)
and bb is average velocity (kilometers)

Gas Chromatographic Analyses .... NORTH BAY DATA
NOVEMBER 24, 1986

		Upwind NOV 18 11:28	Dwnwd NOV 18 15:05	Light & ? Dwnwd NOV 19 14:33	Brisk & Dwnwd NOV 20 09:43	Brisk & Dwnwd NOV 20 11:28	Brisk & Dwnwd NOV 20 12:30	Brisk & Dwnwd NOV 20 13:30	AVERAGE 18 & 19	AVERAGE 20th
1	PROPANE	5.1	8.2	5.4	8.4	7.8	5.3	4.8	6.2	6.6
2	2-METHYLPROPANE	10.2	18.5	2.6	2.7	2.2	1.6	1.9	10.4	2.1
3	BUTANE	41.1	79.9	12.1	12.9	6.4	5.0	7.5	44.4	8.0
4	2-METHYLBUTANE	19.2	27.6	6.6	3.0	2.4	1.9	3.1	17.8	2.6
5	PENTANE	13.8	23.0	5.6	2.2	1.8	1.3	2.1	14.1	1.8
6	CYCLOPENTANE	1.5	1.8	0.8				0.3	1.4	0.3
7	TRANS12DICHOROETHANE	7.4	9.0	2.8		0.7		0.9	6.4	0.8
8	2,3-DIMETHYLBUTANE	1.5	1.4	0.5				0.2	1.1	0.2
9	2-METHYLPENTANE	8.5	8.4	3.1	1.1	0.8	0.7	1.1	6.6	0.9
10	3-METHYLPENTANE	5.8	5.3	2.0		0.6	0.5	0.8	4.4	0.6
11	HEXANE	7.7	7.7	2.7			0.6	1.1	6.0	0.8
12	METHYLCYCLOPENTANE	4.4	3.4	1.3	0.5	0.3	0.3	0.5	3.0	0.4
13	1,1,1-TRICHLOROETHANE		4.5	3.1		5.9	4.5	5.6	3.8	5.3
14	BENZENE	7.8	5.1	3.9		2.6	4.1	2.9	5.6	3.2
15	CYCLOHEXANE	1.3	0.8	0.4		0.1		0.2	0.8	0.1
16	2,3-DIMETHYLPENTANE	4.7	2.7	1.3			0.2	0.5	2.9	0.4
17	2-METHYLHEXANE	5.3	3.1	1.5		0.3	0.3	0.6	3.3	0.4
18	3-METHYLHEXANE	3.3	2.0	1.1			0.2	0.4	2.1	0.3
19	2,2,4-TRIMETHYLPENTANE	0.9		0.5				0.3	0.7	0.3
20	HEPTANE	1.6	0.8	0.5					1.0	
21	TOLUENE	6.0	3.5	3.6				2.4	4.3	2.4
22	2-METHYLHEPTANE	1.0	0.7	0.2					0.6	
23	3-METHYLHEPTANE	2.0	1.0	0.5				0.2	1.2	0.2
24	2-METHYL-1-HEPTENE	1.4	0.5	0.3					0.7	
25	ETHYLBENZENE	1.8	1.1	1.2					1.3	
26	M-XYLENE	7.7	3.2	3.3	1.5		1.2	1.2	4.7	1.3
27	4-METHYLOCTANE	1.0	0.3	0.2					0.5	
28	O-XYLENE	3.3	1.4	1.5	0.7		0.5	0.5	2.1	0.5
29	NONANE	1.1		0.4					0.7	
30	3-ETHYLTOLUENE	3.2	0.6	0.8					1.5	
31	1,3,5-TRIMETHYLBENZENE	2.8	0.9	0.8					1.5	
32	2-ETHYLTOLUENE	1.7		0.5					1.1	
33	1,2,4-TRIMETHYLBENZENE		2.0	1.8					1.9	
34	tert-BUTYLBENZENE	3.5	2.2	2.1					2.6	
35	DECANE	3.0	1.3	1.4					1.9	
36	1,2,3-TRIMETHYLBENZENE	2.7	0.8	0.6					1.3	
37	INDAN	1.3							1.3	
38	UNDECANE	11.7	7.8	6.3	1.0				8.6	1.0
39	1235-TETRAMETHYLBENZENE	2.5		0.4					1.5	
40	DODECANE	2.1	4.0	1.8					2.6	

TABLE #4

Total Compounds Identified	38	35	39	10	13	16	23	37	16
Total # of Peaks	90	73	81	30	52	46	43	81	43
Total Area of Peaks	8340	6001	5564	6384	7655	5094	18500	6635	9408
Area of Identified Peaks	7774	5290	4879	2555	4421	2909	4082	5981	3492
Area % Identified Peaks	93.2	88.2	87.7	40.0	57.8	57.1	22.1	89.7	44.3
Total Hydrocarbons ug/m3	213.73	246.41	85.87	33.89	31.84	28.01	39.45	182.0	33.3
Alkanes ug/m3	152.66	203.71	56.53	31.28	22.13	17.55	24.79	137.6	23.9
Cycloalkanes ug/m3	7.15	6.01	2.56	0.46	0.44	0.28	1.22	5.2	0.6
Alkenes ug/m3	1.35	2.66	0.88	0	0	0	0	1.6	0.0
Cycloalkenes ug/m3	0.48	0	0	0	0	0	0	0.2	0.0
Alkynes ug/m3	0	0	0	0	0	0	0	0.0	0.0
Aromatics ug/m3	45.18	20.6	20.34	2.15	2.61	5.69	6.94	28.7	4.3
Chlorinated alkanes ug/m3	0	4.48	3.12	0	5.94	4.49	5.6	2.5	4.0
Chlorinated alkenes ug/m3	7.44	8.95	2.81	0	0.72	0	0.9	6.4	0.4
Chlorinated aromatics ug/m3	0	0	0	0	0	0	0	0.0	0.0
"X" Unknown @ 2.2/2.3 min (peak area count only)	10	33	343	3287	2651	2042	13712	129	5423
% of total area of peaks	-	-	6.2	51.5	34.6	40.1	74.1	2.1	50.1

TABLE #4

TABLE #5 MOBILE TAGA AIR MONITORING SURVEY: NORTH BAY 1986
SOURCE: REICHHOLD LIMITED

Sample No.	Date	Monitoring Period	Site No.[1]	Met. Con.[2] AT	WD	WS	Phenol Conc. (ug/m³)[3] ½-hr	(SHR)	Comments
1-1	18/11/86	13:00-13:30	1	-9	N	0-6	ND	(ND)	Background, not downwind; no odours
3-1	19/11/86	12:37-13:07	3	-4	S	0-5	ND	(ND)	plume aloft, winds too light, no odours
3-2	19/11/86	13:34-14:04	3	-5	SW	0-7	3.2	(31)	occasional SW winds, no odours
3-3	19/11/86	14:34-15:04	3	-5	S→E	0-3	ND	(ND)	not downwind, winds→E, no odours
3-4	19/11/86	15:04-15:34	3	-5	S→E	0-3	ND	(ND)	not downwind, winds→E, no odours
4-1	20/11/86	10:03-10:33	4	-6	E	10-20	23	(150)	phenolic odours, plume impinging frequently
4-2	20/11/86	10:33-11:03	4	-6	E	10-20	7.3	(80)	intermittent phenolic odours
5-1	20/11/86	12:25-12:55	5	-5	E	5-20	36	(150)	phenolic odours present
5-2	20/11/86	13:05-13:35	5	-5	E	5-20	28	(100)	phenolic odours present

Note [1] See Figure 4 for sampling locations

[2] AT = ambient temperatures (°C); WD = predominant wind direction; WS = range of wind speeds (km/hr)

[3] ½-hr = 30-minute averaged concentration of ambient phenol (ug/m³); (SHR) single highest (instantaneous) phenol level in ½-hr monitoring period. ND = not detected above 1 ug/m³

A18717/GD

TAGA 3000 SYSTEM

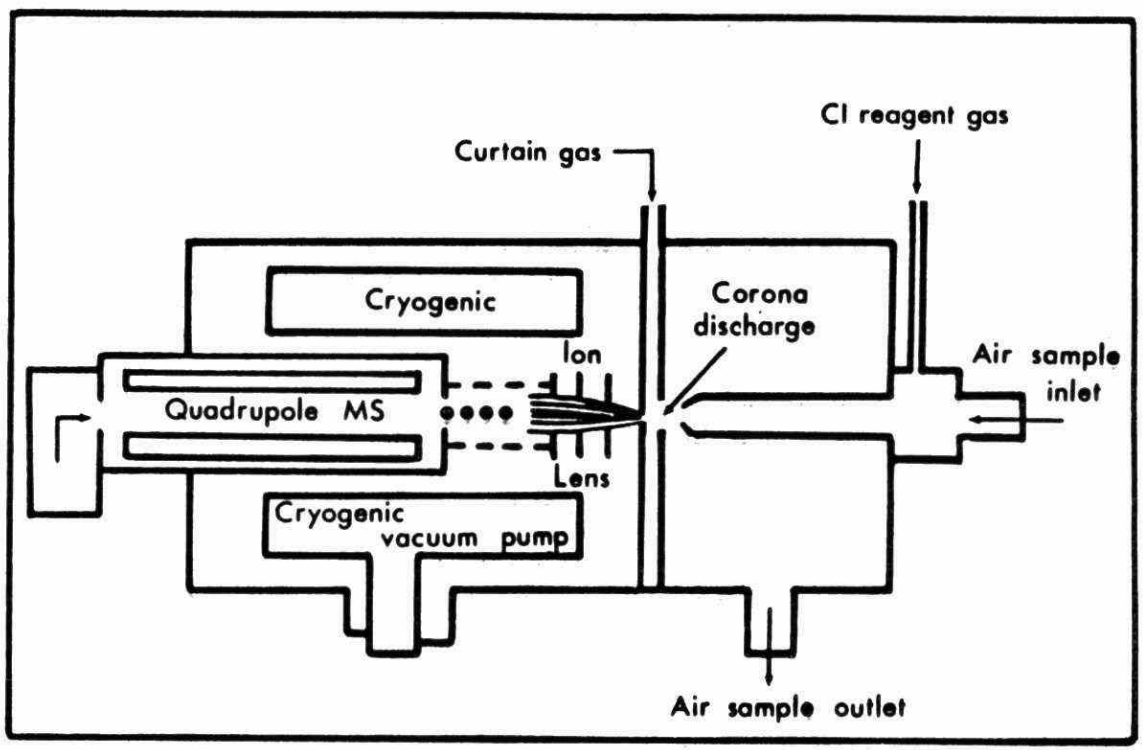
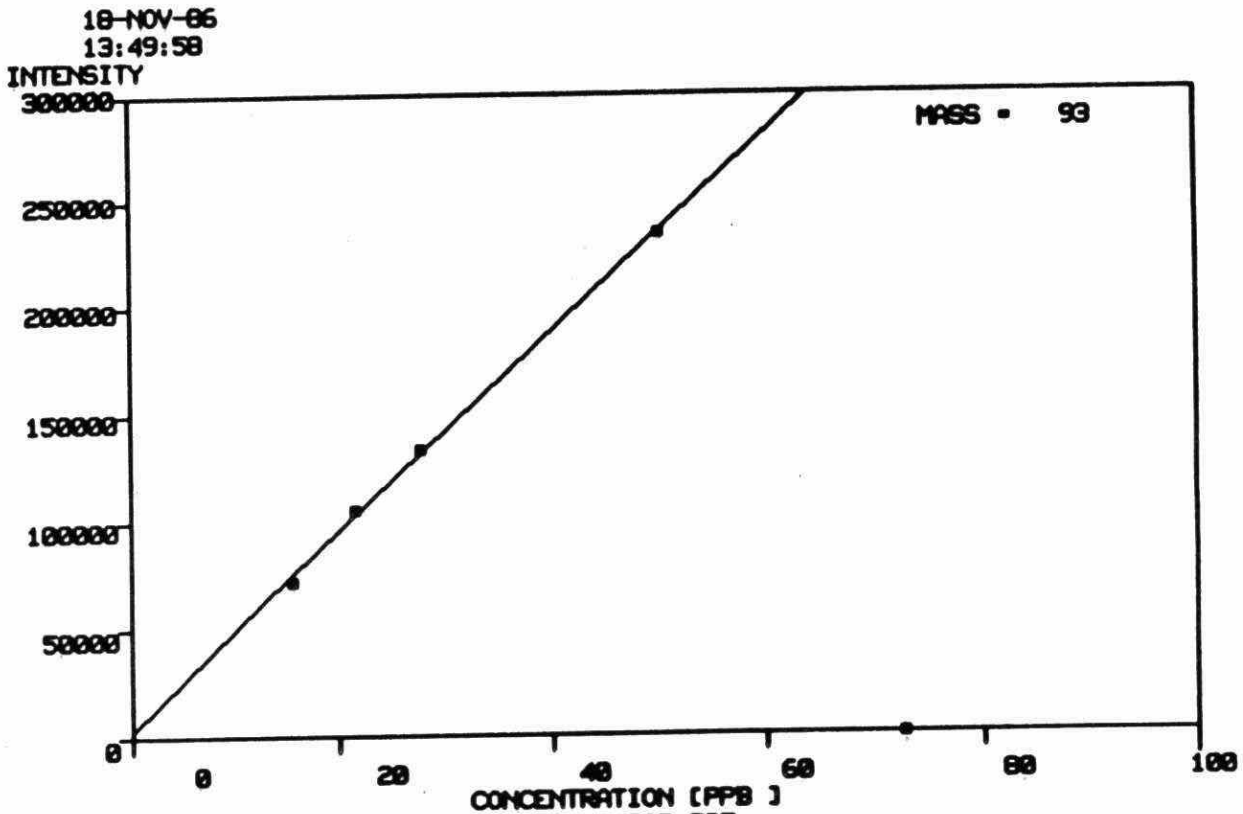


FIGURE 1: SCHEMATIC OF THE TAGA 3000 SYSTEM INSTALLED IN MAMU #3



CALCULATED FIT - MEASURED POINTS AND LINEAR FIT
PHENOL CALIBRATION 02 CI LCB

LEAST SQUARES LINEAR REGRESSION RESULTS

MASS	N	SLOPE	INTERCEPT	R2
93.0	4.	4645.852	2682.847	0.9992

FIGURE 2: EXAMPLE OF PHENOL CALIBRATION ACQUIRED BY MOBILE TAGA UNIT.

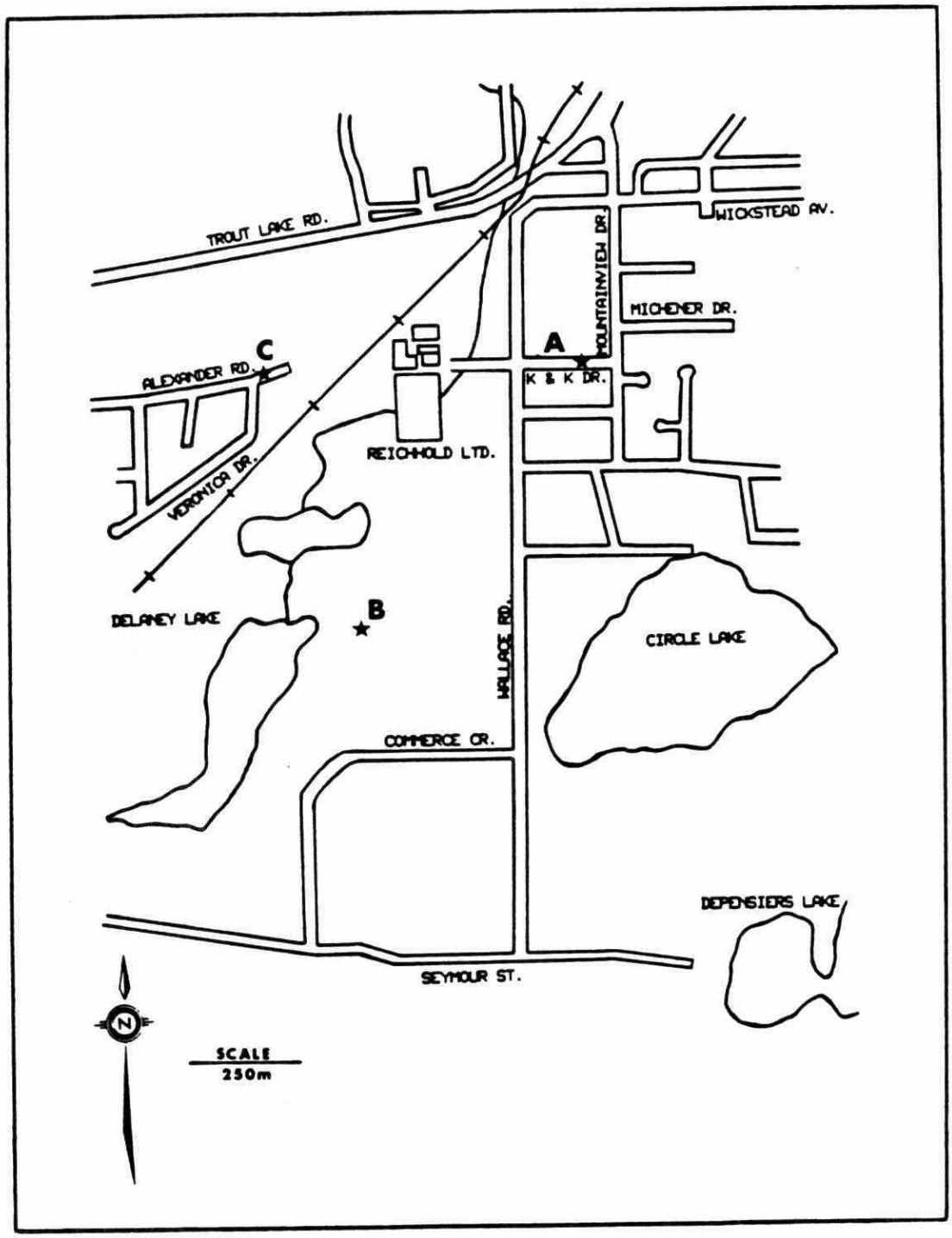


FIGURE 3: MAMU #1 MONITORING LOCATIONS
NORTH BAY NOVEMBER, 1986.

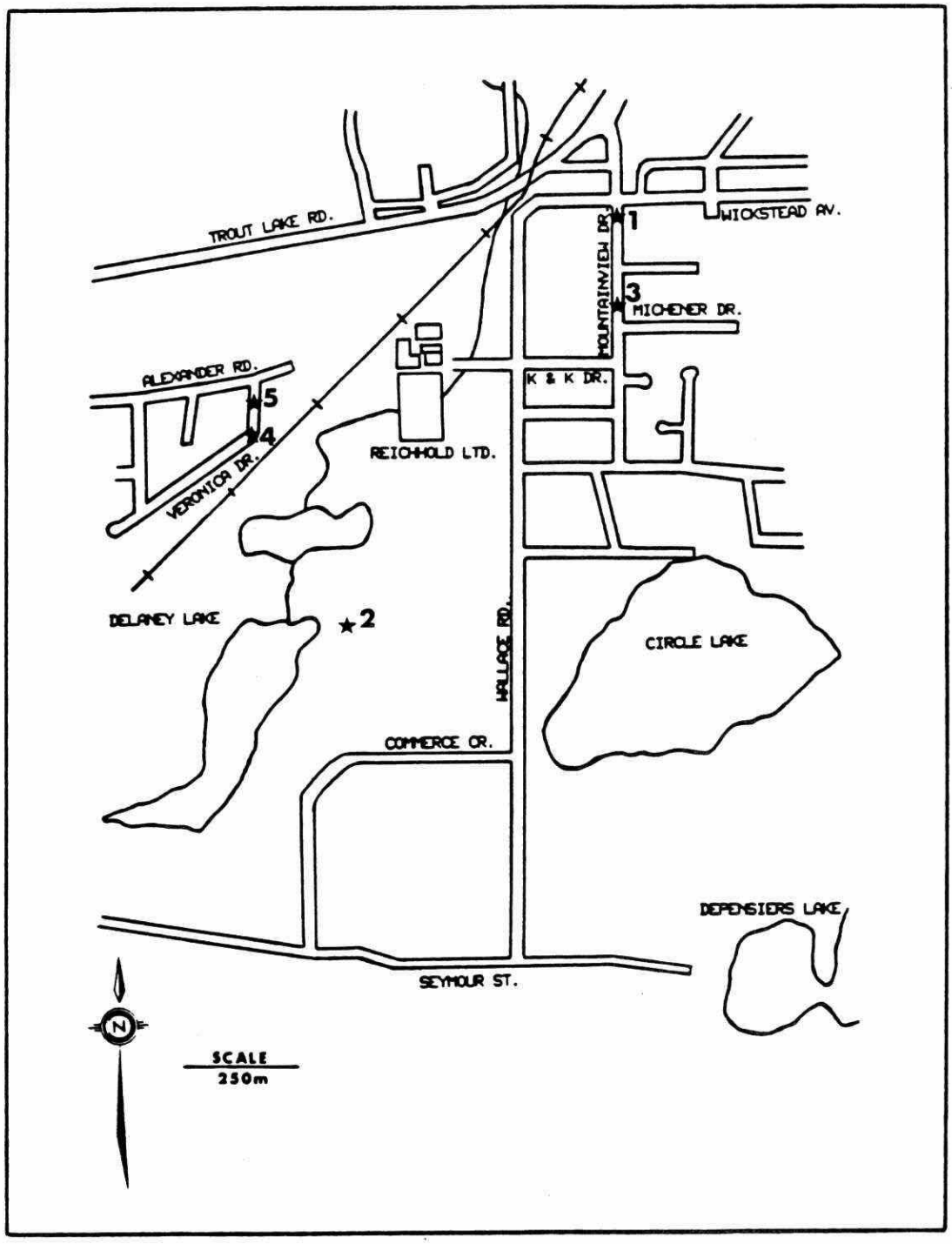


FIGURE 4: MAMU #3 (TAGA) MONITORING LOCATIONS
NORTH BAY NOVEMBER, 1986.

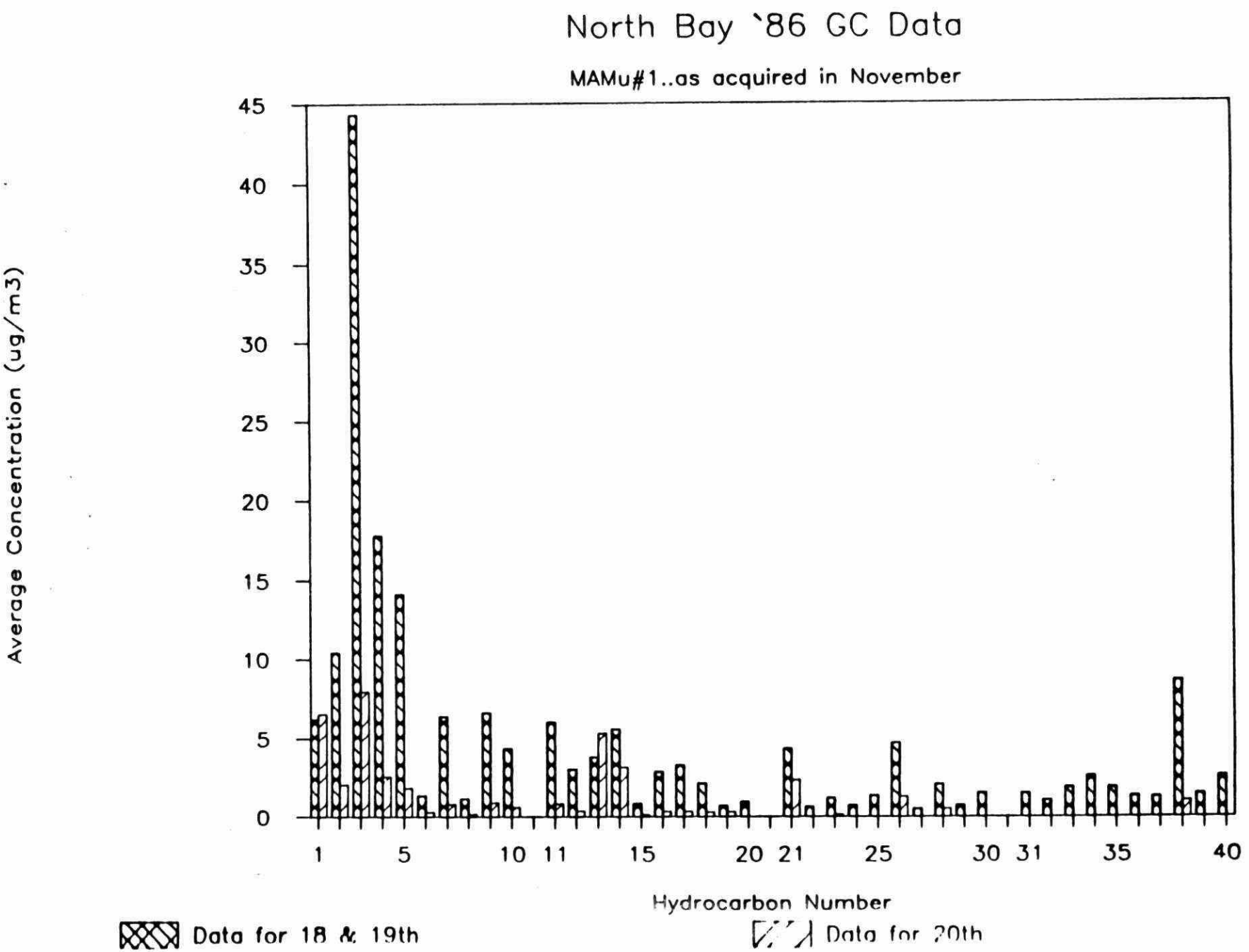


FIGURE 5: MAMU #1 GC DATA

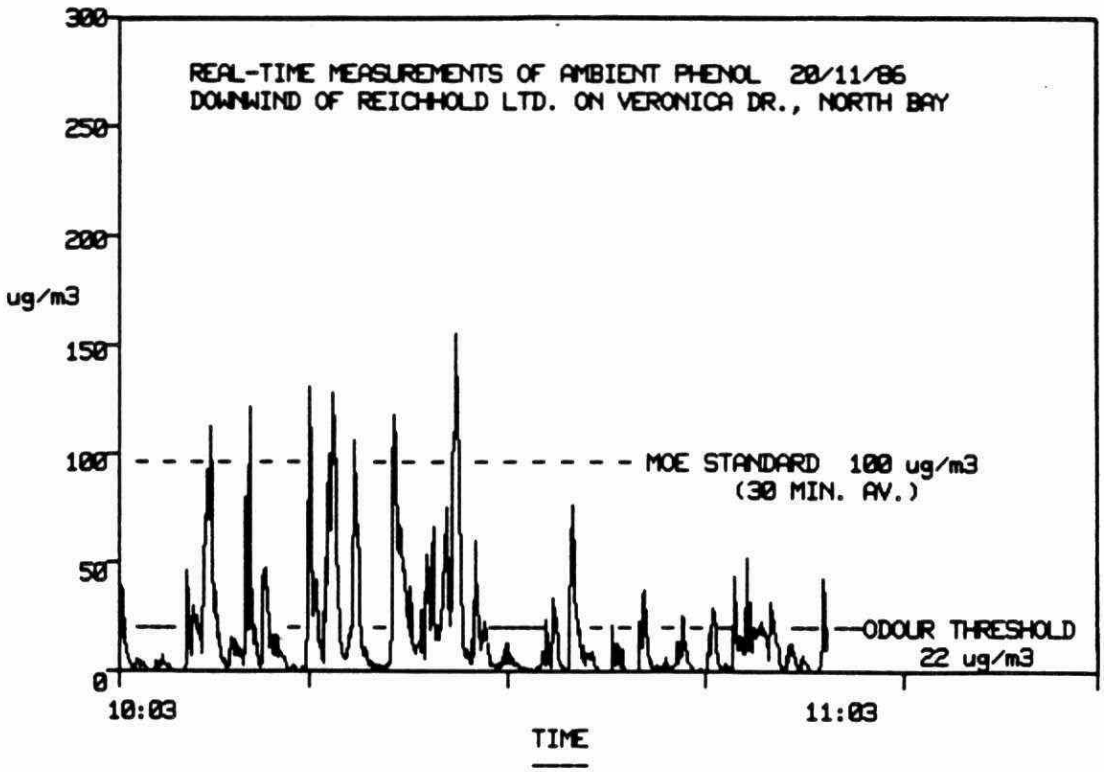


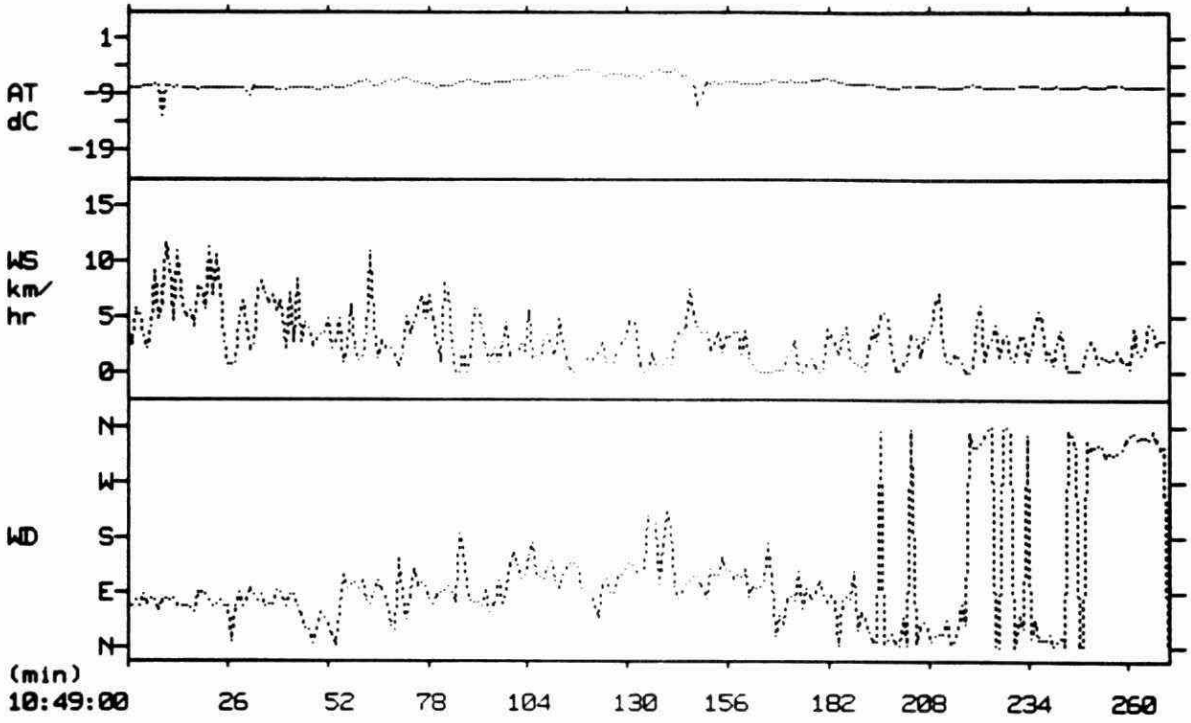
FIGURE 6: EXAMPLE OF REAL-TIME MEASUREMENTS OF PHENOL
MEASURED BY MAMU #3. SITE #3
FIRST 1/2-HR. AV. 23 ug/m3
SECOND 1/2-HR. AV. 7.3 ug/m3

APPENDIX A

Meteorological Data
Mobile TAGA Station
Reichhold Survey, North Bay (1986)

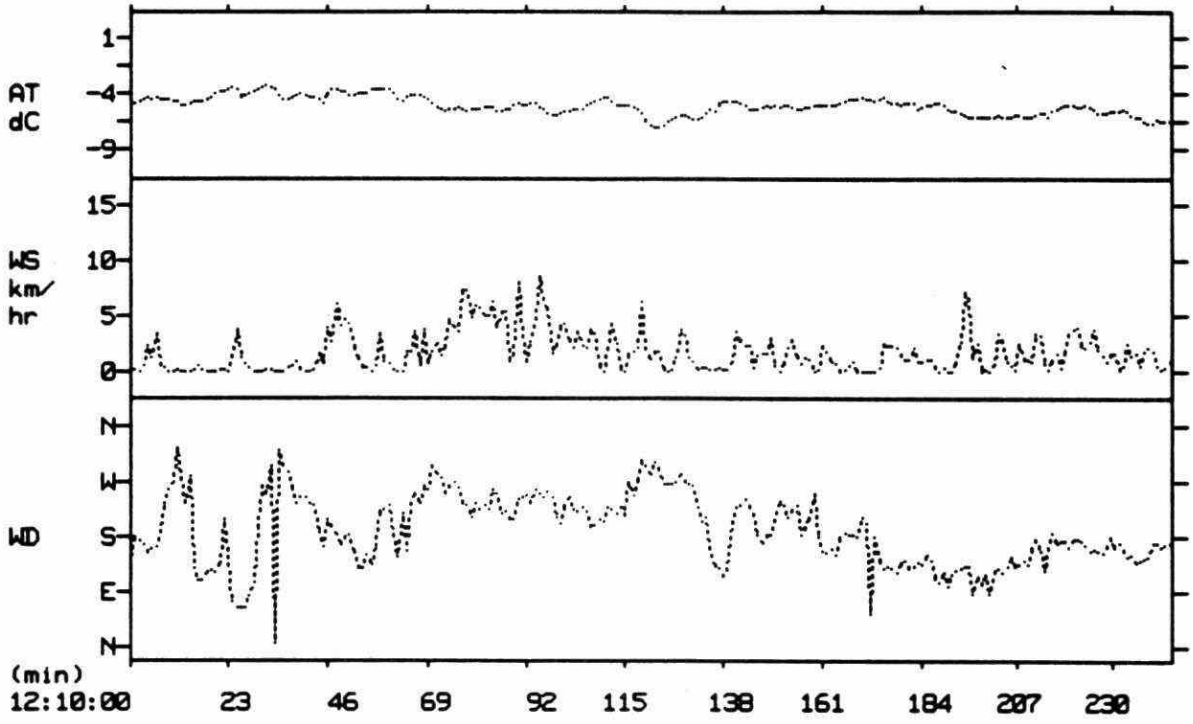
NORTH BAY:WICKSTEAD

Start: 86/11/18 10:48:30 File: NB1801.MET
Scan : 30 sec Ave: 1.00 min Rep: 1.00 min Rnd: 1.0 min
Loc : WICKSTEAD & MOUNTAINVIEW, PINTO FOODS P.L. SITE #3
Met : COLD & SUNNY



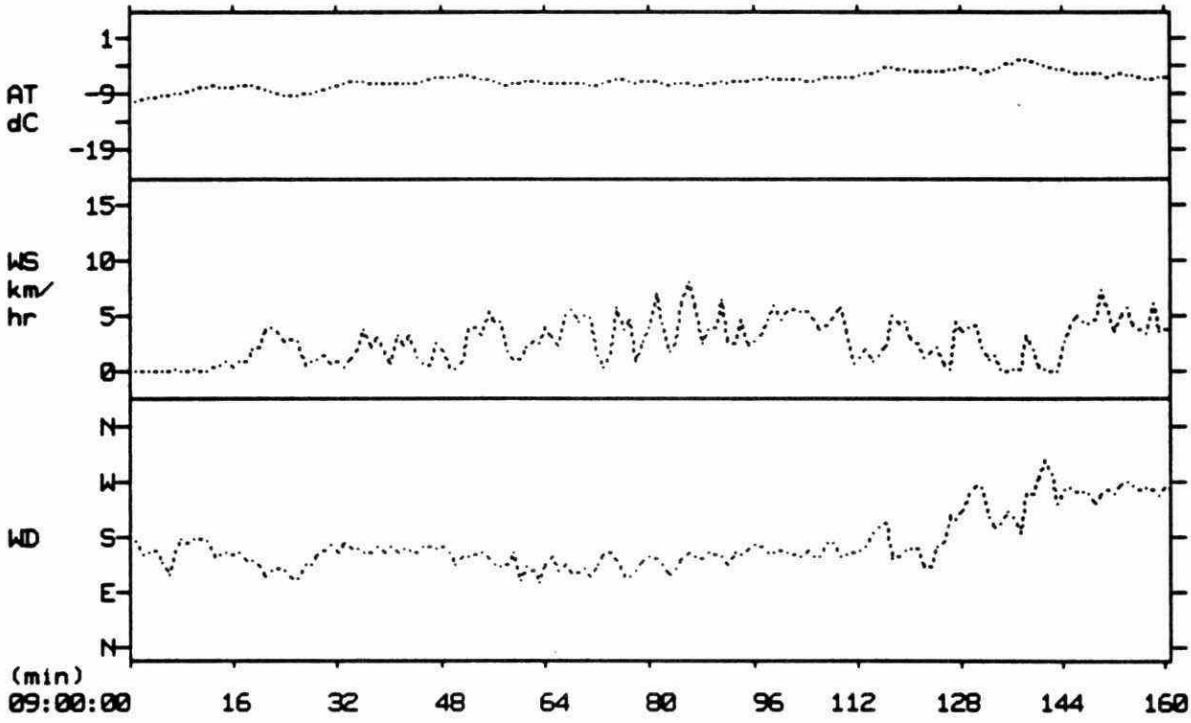
NORTH BAY:MOUNTAINVIEW

Start: 86/11/19 12:09:30 File: NB1903.MET
Scan : 30 sec Ave: 1.00 min Rep: 1.00 min Rnd: 1.0 min
Loc : ON MOUNTAINVIEW NORTH OF MICHENER SITE #1
Met : SUNNY, CLEAR & COLD



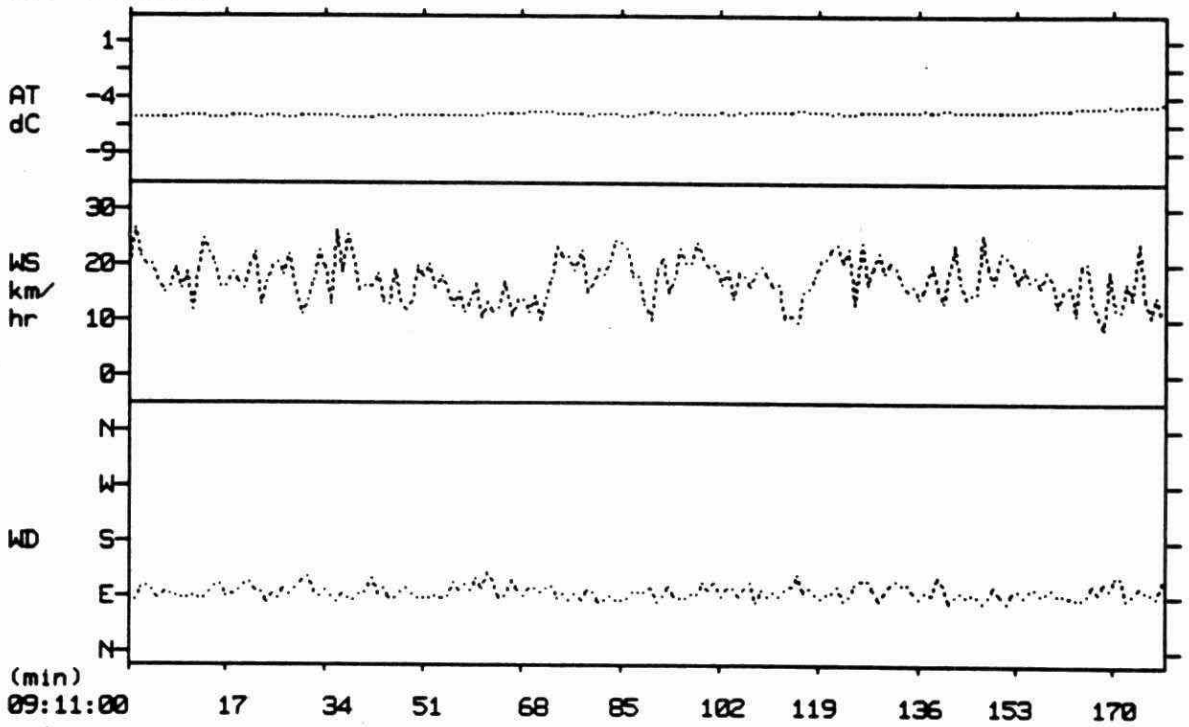
NORTH BAY:COMMERCE

Start: 86/11/19 08:59:00 File: NB1902.MET
Scan : 30 sec Ave: 1.00 min Rep: 1.00 min Rnd: 1.0 min
Loc : BACK P.L. OF CANDORE COLLEGE OFF COMMERCE CR. SITE #2
Met : SUNNY, CLEAR & COLD



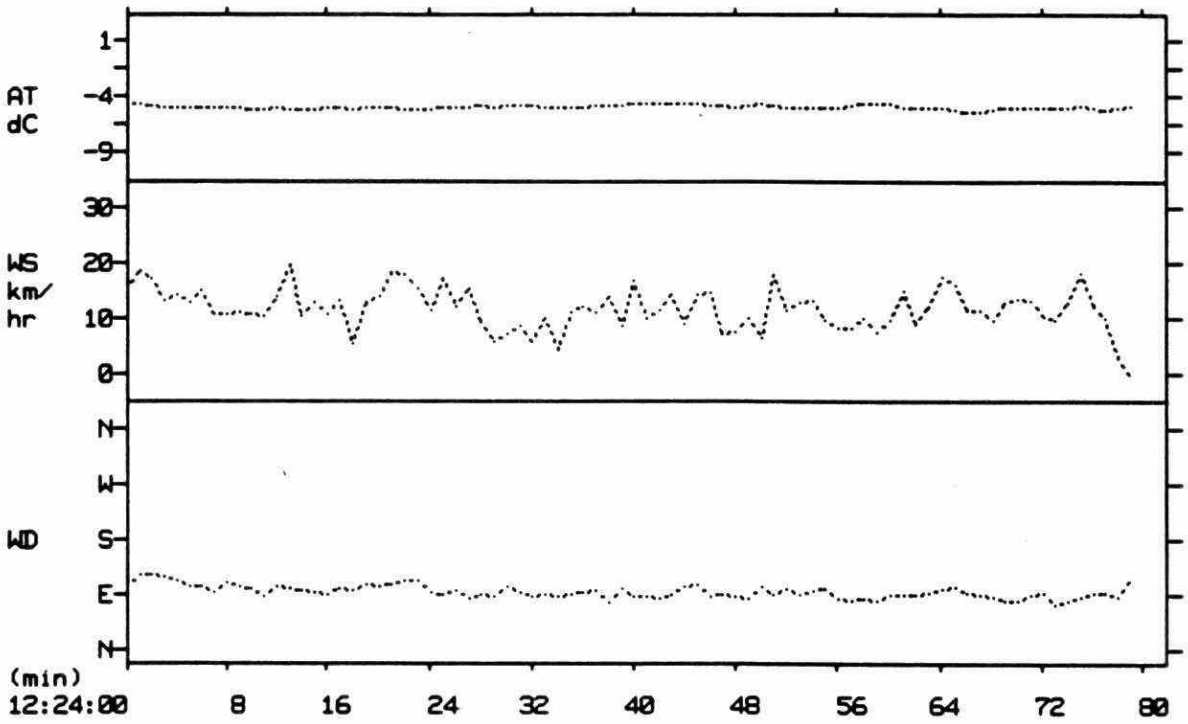
NORTH BAY: VERONICA

Start: 86/11/20 09:10:30 File: NB2004.MET
Scan : 30 sec Ave: 1.00 min Rep: 1.00 min Rnd: 1.0 min
Loc : MIDDLE OF VERONICA DR. SITE #4
Met : OVERCAST



NORTH BAY:VERONICA

Start: 86/11/20 12:23:30 File: NB2005.MET
Scan : 30 sec Ave: 1.00 min Rep: 1.00 min Rnd: 1.0 min
Loc : 25 VERONICA DR. 100M NORTH OF SITE #4 SITE #5
Met : SNOW



REFERENCES

1) "Compilation of Odour Threshold Values in Air and Water" June 1977, editors: L.J. van Gemert, Central Institute For Nutrition and Food Research TNO, and A.H. Nettenbreijer, National Institute for Water Supply, Netherlands.

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